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tions and interpretations of adaptation of various extinct races. Most of them will be welcomed and accepted; some may need further consideration; a few seem open to serious criticism. The discussion of the carnassial teeth of carnivora ignores their most essential feature, the shearing adaptation. The hypothesis that the inner digit of the fore foot in amphibia is primarily absent, and its presence in reptilia and mammalia is a "neuerwerbung," will not commend itself to many; nor will the interpretation of the Stegocephalia and Cotylosauria as fossorial adaptations be readily reconciled with the strikingly paddle-like construction of the feet in these animals, especially the former. But these and a few other points are occasional lapses from the normally high standard of thorough and up-to-date information and good judgment. The book will rank as one of the most important and readable contributions to paleontologic literature, and be indispensable to every one who wishes to understand and teach the real meaning of extinct animals and their relations to the world in which they lived.

W. D. MATTHEW

Inheritance in Maize. By E. M. EAST and H. K. HAYES.

This is an interesting and important contribution from the Bussey Institution of Harvard University, which has appeared as Bulletin 167 of the Connecticut Agricultural Experiment Station. It presents a very thorough study from the Mendelian standpoint of a number of characters of the Indian corn plant and their method of transmission. The interest in this study, however, is by no means confined to its connection with the improvement of this, our greatest agricultural crop, for many of the principles involved have a significant bearing upon several of the more general problems of heredity.

The bulletin, embracing as it does so many different considerations, scarcely admits of a summary that would be short and at the same time intelligible. It is the present purpose, therefore, merely to indicate the general plan and scope of the work by mentioning briefly a

few of the many interesting points touched upon.

After a short introduction in which the authors point out the advantages and disadvantages offered by the maize plant as material for study of genetics, the subject is conveniently divided into five parts.

In Part I. is presented the *material and the problem*, and the corn plant, *Zea mays*, is considered in its systematic relationships. Different classifications are considered, but the well-known one of Sturtevant, slightly modified, is finally adopted as being the most practical and convenient. In this connection there is some speculation in regard to the origin of maize based upon the facts brought out in the investigation concerning the transmission of its characters. After reviewing briefly some of the theories proposed by other authors the suggestion is here offered that maize is derived from teosinte or some similar plant. The maize ear represents an evolutionary product derived by progressive meristic variation of the central spike of the lateral tassels of the teosinte. Other changes are to be accounted for in the accession or dropping of characters, the transmission being in accordance with Mendel's principles.

Mention is then made of the work of previous investigators of inheritance in maize. It is interesting to note how very close some of these workers were, in the days of the eighties and nineties, to the rediscovery of Mendel's law, yet failed to recognize its operation in their results. It is also interesting to note that *Zea mays* is the plant that furnished the data which finally did lead to the rediscovery of the law on the part of both de Vries and Correns.

Next follows a catalogue description in detail of each of the twenty-nine ears of corn that formed the parentage of the various hybrid combinations used in this investigation. Experimental methods and precautions are described. Very much of the value of this report depends upon the painstaking care with which the investigation was carried out, as for example, the previous inbreeding of all the stock used, in order to establish purity. An-

other tremendous advantage is gained by going to the trouble of making separate pedigree cultures of the various lines, thus admitting an analysis of results, such as was sometimes impossible in the case of the work of previous investigators in this field.

Part II. deals with *endosperm characters*, and under this subject is taken up first the transmission of starchiness of endosperm. Although the behavior of this character as to dominance and segregation is already known, the matter is made the subject of an unusually thorough and critical study here because of the sharpness and completeness with which starchiness segregates and with the idea of applying this study to some fundamental principles in their connection with Mendelism, such as prepotency and gametic purity. In all the large number of cases examined the behavior in this respect is found to be so regular as to force the conclusion that "the mechanism by which the members of an allelomorphic pair are distributed among the gametes is accurate," and none of the extra explanations offered by some other investigators to account for discrepancies are needed here.

In connection with the transmission of yellow and non-yellow endosperm, an important principle is brought out; namely, that in certain strains of corn yellowness is not a simple unit, but rather is the result of two distinct and independent yellow units or factors operating to give precisely a di-hybrid effect. This is an important observation, in that the same principle may be carried to various other characters supposed to be simple, but which in reality may prove, upon more critical analysis, to be compound, depending upon the operation of a series of units or factors.

The transmission of endosperm colors has been left rather vague by the experiments of previous investigators in this field. Some of the discrepancies in the results of Correns and of Lock with respect to the behavior of purple aleurone colors are now explained by the present investigation; thanks to the separate pedigree culture making possible a more thorough analysis of data. It is found that the

behavior in this regard is not always constant, but varies in different strains or families, apparently depending upon the constitution of the uniting gametes. The conception of certain developer and inhibitor factors serves to explain quite satisfactorily most of these cases, and it is believed that when all of the facts are known, most, if not all, of these discrepancies and contradictions will be similarly explained, and thus will be wiped out some more of the seeming exceptions to the law of Mendel.

Part III. is a discussion of *Xenia* and the observations here are in the main in accord with those of previous investigators. On account of the various effects of dominance in different cases some confusion has arisen concerning this phenomenon. An explanation of these cases is given in connection with which the following law regarding *Xenia* is formulated:

"When two races differ in a single visible endosperm character in which dominance is complete, *Xenia* occurs only when the dominant parent is the male; when they differ in a single visible endosperm character in which dominance is incomplete or in two characters both of which are necessary for the development of the visible difference, *Xenia* occurs when either is the male."

In Part IV. is considered the inheritance of a number of *plant characters*. In the case of the podded kernel the presence of pods is found to be a perfect dominant. In the investigation of pericarp colors a number of different kinds of reds are distinguished. Red in cob color was found to behave as a simple character in the cases examined, but red color in silks appears to be more complex in its inheritance.

A section is devoted to the matter of *physical transformation of starchiness*, and a study of the crosses between soft starchy and corneous starchy sort brings out the following three facts: "The characters that give the flint or the dent appearance to maize are transmitted as plant characters to the entire ear and not as endosperm characters to the individual seed. They conform to the essen-

tial feature of Mendelism by showing segregation; and they are due to the action of more than one transmissible character."

A discussion of *size characters* is next taken up, including observations on numbers of rows of kernels on ear, height of plant, length of ear and size of seed. Studies of these characters are naturally beset with complications, the results being often obscured by the influence of environmental effects. However, the experiments disclosed segregation with respect to these characters, and the conclusion is therefore drawn that size characters do mendelize. Perhaps the most important point in this connection is the suggestion that in such cases which have heretofore ordinarily been considered as continuous variations, we may actually have to do with a series of Mendelian factors in operation, naturally quite difficultly discernible on account of the complex polyhybrid ratios involved, the absence of dominance, and the obscuring effect of environmental influences.

Part V. contains an account of a number of interesting *abnormalities* which arose among these various cultures. The appearance of several dwarf plants is described, but their significance is rather obscure, since no ratios were obtained. Bifurcated ears transmitted this abnormality as a dominant. In the case of striped foliage arising as though by mutation in some of these strains, the striped plants are considered to be heterozygous.

Aside from the interesting content of the bulletin, the authors are to be congratulated on its general appearance and make up. It is well illustrated by 25 plates of excellent photographic reproductions. The data are well chosen and presented in very convenient arrangement.

L. H. SMITH

NOTES ON METEOROLOGY AND CLIMATOLOGY

THE MOST NORTHERLY SCIENTIFIC INSTITUTION

THE weather observatory recently established by the Norwegian Meteorological Institute at Spitzbergen, 1,100 miles north of Christiania, is the most northerly permanent scientific institution of any kind in the world.

Meteorological data are communicated to the central office by means of wireless telegraphy *via* Green Harbor. The progress made at the observatory may be watched with interest, as it is hoped that the data there obtained will aid in European weather forecasting. The Norwegian project is separate and distinct from the German expedition, headed by Drs. Wagner and Rempp, which is now carrying on research in aerology and geophysics in Spitzbergen.

THE ANNUAL REPORT OF LINDENBERG OBSERVATORY

THE report of the Royal Prussian Aeronautical Observatory at Lindenberg for the year 1910 has recently appeared. As has been the case during several years, preceding, upper-air investigations were conducted daily, without a single exception, throughout the year. The meteorograph was elevated by means of kites 459 times, and by means of captive balloons 211 times, the average height with the former method being 9,866 feet, and with the latter 9,898 feet, both of which are higher than the corresponding averages for any earlier year. Of 29 registering balloons sent up 27 were recovered, and the average height attained was 49,028 feet (9.3 miles). On August 20 the greatest height yet reached at Lindenberg was recorded, the barograph indicating a height of 82,138 feet (15.6 miles). 177 pilot balloons carrying no recording instruments were also sent up during the year, data of wind velocity and direction aloft being obtained from these ascensions. In addition to the aerological data, which are printed in detail, the report contains five papers prepared by various members of the observatory staff.

WATER VAPOR IN THE ATMOSPHERE

IN observations with a telescope, bolometer or pyrliometer the approximate amount of water vapor in the atmosphere is an important factor. The determination of this amount by spectroscopic methods is not very satisfactory. In order to simplify the evaluation of this factor Professor W. J. Humphreys has examined the data obtained in 74 balloon flights made on cloudless days. Conditions on